Impact of monetary policy on lending and deposit rates in Pakistan: Panel data analysis

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The study estimates impact of monetary policy rate on lending and deposit rates in Pakistan using bank type data from November 2001 to March 2011. The study finds evidence of long run relationship between lending and discount rate but deposit rate is not cointegrated with discount rate, monetary policy instrument. The study also finds an increase in the lending rate pass through rate during contractionary monetary policy times (2005-2010), whereas deposit rate pass through remains same. The study finds that overall banks pass on only 20% impact of a change in discount rate to the lenders in first month implying it is not complete. There is also significant difference in various bank types pass through rates. The pass through of deposit rate is further low at 0.16 as revealed by short run analysis. It implies that the effectiveness of monetary policy is limited in Pakistan.

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I. Introduction:

Interest rate is one of the tools of monetary policy. Pass through is the transmission of bench mark interest rate, Discount rate (DR) in our case, to lending and deposit rates in the economy. The pass through is complete if any change in DR is transmitted to the lending and deposit rates immediately.[1] The completeness implies monetary policy is very effective and central bank can influence output and consumption without much delay.

Many studies have estimated the degree of pass through for the developed countries e.g. European countries, USA, UK etc.[2]There is no consensus regarding completeness of pass through. Some studies reported completeness in the pass through process with respect to bench mark monetary policy instrument e.g. Bernanke and Gertler (1995), Kashyap and Stein (2000) and Althunbas et al. (2002) and Cook Steve (2008). Whereas, some studies contradicted these findings and provided empirical evidence in favor of incompleteness of pass through recently. The studies also found heterogeneity across countries, financial institutions and retail bank products e.g. Mojon (2000), Bond t (2002), Hoffman and Mizen (2004), Liu Ming-Hua et al. (2008) and Ozdemir Bilge Kagan (2009). The studies focusing on pass through in Euro zone used Non-Harmonized Retail Interest Rate Statistics (NRIR) e.g.Mojon (2000), Heinemann and Schuler (2002), Debondt(2002, 2005), Toolseema et.al. (2002), Sander and Kleimeir(2002, 2004). Some studies used individual retail bank data, Cottarelli, Ferri and Generale(1995), Weth (2002), Gambacorta(2004) and Degraeve Dejonghe and Vannet (2004).

Ozdemir Bilge Kagan (2009) estimated pass through between money market rate and bank's retail rate for Turkey. There is a limited body of literature on developing countries like Pakistan. Qayyum, Khan, and Khawja (2005) estimated the pass through of TB rate on Call Money Rate, saving deposit rate, six-month deposit rate and lending rate. They used 6 month deposit rate and lending rate data from 1991:03 to 2004:12 and used

[1] Romer and Romer (1989) and Bernanke Blinder (1992)

[2] Mojon(2000), Bond t(2002), Graeve Ferre De et al. (2004), Kleimeier S. and Sander H. (2006), Sorensen C. Kok et al. (2006), Liu Ming-Hua et al. (2008) etc.

Transfer Function Approach. Mohsin and Rivers (2011) measured pass through between Treasury Bill (TB) rate and retail rates in the case of Pakistan. They found that although pass through is not complete but the degree of pass through is moderately high. The State Bank of Pakistan presently using Discount Rate as a monetary policy tool although in the past has used various other tools too.

This study attempts to measure pass through between DR and retail rates using monthly data from November 2001 to March 2011. The weighted average lending and deposit rates data of four types of banks i.e. Private Domestic banks, Foreign Banks, Nationalized banks and specialized banks using the weighted average lending and deposit rate. Furthermore, the study intends to include a time dummy to capture the effect of monetary policy restriction on the pass through rate. It will help to find whether banks change their pass through rate while there is an increase in policy rate. The comparison of pass through in the case of various categories of banks' retail rates and DR will be an interesting extension of the ongoing research in Pakistan.

2. Methodology: My study intends to use Panel data techniques. First I will apply Panel Unit Root Tests to check for the stationarity of data. Then Pedroni Panel Cointegration tests shall be applied to check for long run relationship between DR and Lending and Deposit rate. Further, Phillips and Loretain (1991) method which is an extension of Engle and Granger (1988) will be applied with cross section dummies.

2.1 Panel Unit Root:

This study will utilize three panel unit root tests to assess stationary data of lending, deposit and DR (Levin et al., 2002; Im et al., 2003; Hadri, 2000).

The Levin, Lin and Chu (LLC) test assumes that persistence parameters remain the same across cross sections. This means that $\psi_i=\psi$ for all *i*. Alternatively, the Im, Pesaran and Shin (IPS) test allows ψ to vary across all cross sections.

The LLC model allows for fixed effects and unit specific time trend along with common time effects. The structure of their model is shown below:

$$\Delta y_{it} = \alpha_i + \delta_i t + \theta_t + \rho_i y_{i,t-1} + \xi_{it,}\ i=1,2\ldots N, t=1,2\ldots T \qquad (1)$$

The unit specific fixed effect is important to capture heterogeneity since the coefficient of the lagged dependant variable is homogeneous across all cross sections in equation 1. Im et al. (2003) extended the LLC framework by allowing heterogeneity in ρ_i under the alternative hypothesis. The Lagrange Multiplier tests of Hadri (2000) have a different null hypothesis than other panel unit root tests. The comparison of the results from all three types of tests will be an interesting and will provide stronger evidence.[3]

2.2 Panel Cointegration:

This study attempts to use the Pedroni (1999, 2004) panel cointegration test to estimate a long run relationship between bank and TB rates. Pedroni derived nearly seven tests which are within- and between-dimensions. Pedroni's tests are residual based, similar to the Engle Granger tests. The slope coefficients vary over cross section units, thereby allowing heterogeneity within the model. The following panel equation is estimated:

$$Y_{it} = \alpha_i + \delta_{it} + \beta_i X_{it} + \varepsilon_{it} \qquad (2)$$

Whereas, $i = 1, 2 \ldots\ldots N$ cross sectional units, $t = 1, 2 \ldots\ldots\ldots T$ time periods, and X_{it}represents the column vector which consists of M independent variables for each ith unit. M represents the number of independent variables. The variables Y and X are considered to be non stationary, I (1) integrated of order one. The residual ε_{it} will be non stationary, I(1), under the hypothesis of no cointegration. The parameters $\alpha_i \; and \; \delta_{it}$ tend to capture cross sectional fixed effects and deterministic trends, respectively. The separate slope coefficients $\beta_i$ensure that cointegrating vectors may also be heterogeneous.

In order to compute the required panel cointegrating statistic, Equation 1 is estimated by OLS, for every individual cross section. The within-dimension based estimates are panel ρ and panel t statistics. They are derived by computing the first difference of all variables.

$$\Delta Y_{it} = \beta_{1i}\Delta X_{1it} + \beta_{2i}\Delta X_{2it} + \cdots \ldots \ldots \beta_{mi}\Delta X_{mit} + \pi_{it} \qquad (3)$$

[3] For details see Mohsin and Rivers (2011) and Baner jee A (1999)

2.3 Phillips and Loretain (PL, 1991) Method

The marginal cost pricing model uses Engle Granger type equation[4]

$$Y_{it} = \alpha_i + \beta X_{it} + \varepsilon_{it} \qquad (4)$$

i=1,2,…..,N and t=1,2……T

Where Y_{it} represents bank lending or deposit rate; X_{it} , the monetary policy instrument, DR, money market rate or federal fund rate; ε_{it}, the residual term; α_i and β measure the mark up and long run degree of pass through respectively.

Liu et al. (2008) estimated the following triangular system of equations to model long run relationship between policy rate and market rates;

$$Y_{it} = \alpha_i + \beta X_{it} + U_{1it}, \qquad t=1, 2,\ldots\ldots, T \qquad (5)$$

$$X_{it} = X_{it-1} + U_{2it} \qquad (5a)$$

Where $U_{it=[U_{1it,}U_{2it}]}'$ is a stationary vector?

The estimation of equation 1 requires both interest rates to be non stationary. If the U_{1it} is not stationary then U_{2it} interest rates will not cointegrate, thereby, resulting in a spurious estimate.

Liu et al. reveals that even if U_{1it} is stationary, OLS estimates of equations 1 and 1a do not have standard distribution when U_{1it} and U_{2it} are correlated. Phillips and Loretain (1991) suggested inclusion of leads and lags of the first difference in $X_{t,}$ ΔX_t. They estimated the following equation:

$$Y_{it} = \alpha_i + \beta_i X_{it} + \sum_{k=1}^{K} d1k\,(Y_{it-k} - \alpha_0 - \beta_i X_{it-k}) + \sum_{i=-1}^{L} d2i \Delta X_{it-i} + v_{i1t} \qquad (6)$$

The parameter estimates are unbiased asymptotically and normally distributed. Use of this model provides two additional advantages. First, this model considers structural changes, if they should occur. Second, it addresses past policy surprises and future policy settings with regard to policy instrument and bank rates.

3.1 Discussion of Long Run Results

[4] Rousseas (1985) and Bondt Gabe De (2002, 2005)

Table 1 provides the summary of Panel Unit Root tests (individual as well as common process) which are applied to check the stationarity of three variables i.e. weighted average lending and deposit rates and Discount rate (Monetary Policy Instrument). In most of the cases I failed to reject the null hypothesis of unit root at levels since the computed probabilities are greater than 0.05. But i can reject the hypothesis of unit root at first difference in most of the cases which implies that the variables are non stationary at levels but stationary at first difference, hence integrated of order one. In the case of Hadri test I can reject the null hypothesis of stationarity in the case of all the three variables but failed to reject the null hypothesis at first difference. Now in order to find evidence of long run relationship, the study applies panel co integration analysis.

Table 2 summarizes the residual based Pedroni's panel cointegration test between lending rate and DR. In the within dimension test, seven out of eight tests reject the null hypothesis of no cointegration. Similarly, in the between dimension case the null hypothesis of no cointegration can be rejected for two out of three cases. The group ADF stat has a probability of 0.06 which is higher than 0.05. Over all there is ample evidence of long run relationship between lending rate and DR with Pedroni Cointegration test. Now the study moves on check the long run relationship between Deposit rate and Discount rate. Table 3 provides Pedroni's residual based panel cointegration tests in the case of deposit rate and DR. In eight within dimension tests, the computed probabilities are estimated to be very high. I failed to reject the null hypothesis of no cointegration in eight out of eight cases. Hence the case of no long run relationship between deposit rate and DR is strong in the within dimension tests. Similarly, in the three between dimension tests, the computed probabilities are more than 0.9 which are very higher than 0.05. I failed to reject the null hypothesis of no cointegration in these tests too. Sorensen Christopher Kok and Werner Thomas (2006) found similar results for saving deposits in the Euro area using Pedroni residual based test. They are of the view that may be the adjustment in saving deposit is so sluggish that there is no cointegration with the market rate.

Table 1: Panel Unit Root Test

Method		Null Hypothesis	Lend		Deposit		DR	
			Stat	**Prob.**	**Stat**	**Prob.**	**Stat**	**Prob.**
LLC- t* Stat	***Level***	Unit Root (common process)	-1.19	0.42	-3.03	0.99	-2.7	0.99
	1st Diff		-15.84	0.00	-8.05	0.00	-6.87	0.00
HADRI-Z	***Level***	Stationary	-6.7	0.00	9.5	0.00	8.67	0.00
	1ST Diff		2.64	0.06	-0.87	0.2	-0.73	0.77*
IPS-W Stat	***level***	Unit Root (individual process)	-1.28	0.10	3.2	0.99	-1.09	0.13
	1st Diff		-16.57	0.00	-7.8	0.00	-10.24	0.00

Table 2: Pedroni Residual based Panel Cointegration Test
Variables: Lending rate and Discount Rate (DR).

Ho: No Cointegration				
Ha: with-in-dimension	**Statistic**	**Prob**	**Weighted Stat**	**Prob**
Panel V Stat	1.9	0.03**	1.2	0.1***
Panel rho-Stat	-1.8	0.04**	-1.33	0.09***
Panel PP-Stat	-1.9	0.02**	-1.7	0.04**
Panel ADF-Stat	-1.6	0.005**	-1.5	0.0*
Ha: Between Dimension				
Group rho-Stat	-2.21	0.01*		
Group PP-Stat	-2.22	0.01*		
Group ADF-Stat	-1.5	0.06***		

Note: *, ** and *** are significant at 1, 5 and 10 percent respectively.

3.2Phillips and Loretain (PL, 1991) estimates with slopes and intercepts dummies:

Table 4 reports 3 types of estimated equations for both lending and deposit rates. Equation 1 estimates PL model without bank type dummies. It incorporates autoregressive order 1,2 to tackle autocorrelation. The Equation 2 includes overall slope and bank type dummies. Wald test has been applied to check whether bank types pass through is different than the overall estimated slope. The Equation 3 provides slope as well as intercept dummies but includes only Autoregressive scheme of order 1. Equation

1 for lending rate estimates the overall slope to be 0.20 which is far below one. It implies that the pass through of DR with weighted average lending rate is not complete. It is noted that the overall pass through parameter decreases with the inclusion of autoregressive terms but Durbin Watson (DW) improves. It means banks pass on only 20% impact of a change in DR to lenders immediately which is very low. The overall pass through in Eq 2 is estimated at 0.10 implying banks pass on only 10% impact of DR to lenders in first month overall. The estimated slope dummies show that the pass through is lowest in the case of Specialized banks and highest in the case of Domestic private banks followed by foreign banks.

Table 3: Pedroni Residual Based Panel Cointegration Test
Variables: Deposit and Discount Rate (DR)

Ho: No Cointegration				
Ha: with-in-dimension	**Statistic**	**Prob.**	**Weighted Stat**	**Prob.**
Panel V Stat	0.28	0.4	0.55	0.3
Panel rho-Stat	1.7	0.95	1.4	0.91
Panel PP-Stat	2.71	0.99	2.24	0.98
Panel ADF-Stat	2.61	0.99	2.13	0.98
Ha: Between Dimension				
Group rho-Stat	1.3	0.89		
Group PP-Stat	2.44	0.99		
Group ADF-Stat	2.34	0.99		

Note: None of computed probabilities less than 0.10, not significant.

The estimated pass through of private banks is 0.32 followed by foreign banks at 0.25. The estimated pass through of nationalized banks is 0.19. I applied Wald test with the coefficient restriction all slopes being equal. The estimated chi-sq value is 7146431 and probability is zero. The null hypothesis of equality of slopes can be rejected in favor of at

least one slope coefficient is different. It implies there is heterogeneity in the response of weighted average lending rates change when DR rate is changed as a tool to implement monetary policy. The DW is 1.80 and goodness of fit explains 97% variations in the model.

The Eq-3 of lending rate estimates overall pass through along with slope and intercept dummies. The overall pass through is 0.15 but the estimated slope parameter of private banks is o.32 followed by 0.24 for nationalized banks and 0.15 for foreign banks. The equation includes only Autoregressive of degree one AR (1) scheme, the DW statistic is 1.3. After the inclusion of AR (2), the results are similar to Equation 2. The study therefore considers Equation 2 as final result. The Eq 4 includes a slope dummy (DR-Dum5) which is 1 after 2005-2010 and 0 otherwise. It is the time State Bank of Pakistan pursued contractionary monetary policy (a consistent rise in discount rate). This slope dummy is positive and significant which implies that banks increased pass through during a rise in monetary policy instrument.

The estimated pass through is low which implies that Pakistani banks only pass on marginal impact of a change in discount rate to the lenders. It also implies that the effectiveness of monetary policy is limited in the first month and takes time for the complete impact.

Table 4: PL (1991) Estimates with dummy variables

Lending-DR				
	Eq-1	**Eq-2**	**Eq-3**	**Eq-4**
	7.8	7.82	8.1	8.3
	(9.5)*	(9.8)*	(17.3)*	(10.8)*
DR (PL)	0.20	0.10	0.15	0.10
	(2.7)**	(1.8)***	(3.2)*	(1.6)***
DR-FB		0.15	0.15	0.02
		(39.7)*	(43.9)*	(11.9)*
DR-NB		0.09	0.24	0.004
		(16.2)*	(104.3)*	(4.3)*
DR-PB		0.22	0.32	0.003
		(37.5)*	(138.2)*	(4.9)*
DR-SB				
DDR	0.25	0.25	0.2	0.92
	(5.7)*	[5.6]*	(3.05)*	(7.6)*
DERL	0.50	0.50	0.50	-0.8
	(44.6)*	(45.3)*	(262.5)*	(-106)*
C1-FB			-2.4	-0.8
			(-23.8)*	(-2.6)*
C2-PB			-3.37	0.91
			(-79.1)*	(4.3)*
C3-NB			-1.8	1.3
			(-24.7)*	(4.7)*
DR*DUM5				0.003
				(3.4)*
Chi-Sq		7146431*		
R-sq	0.97	0.97	0.97	0.99
DW	1.8	1.8	1.3	1.76

Table 5: SR Analysis for Deposit and Discount Rate

Eq.1

D (DEP) = -0.002 + 0.16*D(DR)
(-0.13) (3.5)*
R^2=0.05 F-Stat=3.8 Prob. (F-Stat) =0.002 DW=1.93

EQ. 2

D (DEP) = -0.02*D (DR) + 0.20*D (DNB) + 0.16*D (DPB) + 0.3*D (DFB)
(-0.4)* (1.92) ** (1.40) (1.96) **

R^2=0.05 F-Stat=2.5 Prob. (F-Stat) =0.02 DW=2.3

EQ. 3

D (DEP) = -0.003*D(DR) + 0.20*D(DNB) + 0.2*D(DPB) + 0.3*D(DFB) + 0.02*D5(DR
(-0.04) (1.9) *** (1.3) (2.01) ** (0.2)

AR (1) =-0.14]
(-2.04)*

R^2=0.07 F-Stat=2.98 Prob. (F-Stat) =0.003 DW=1.94

Note: *, **, *** imply significant at 1, 5 and 10 % respectively

4. SR Analysis for Deposit and Discount Rate:

Since deposit rate and discount rate do not have long run relationship, the study extends the analysis to short run. Table 5 reports the results in the form of three equations. The variables are in first difference form. The Eq 1 estimates fixed effect model where there is overall pass through of discount and deposit rate is estimated in short run. The pass through is 0.16 and it is found statistically significant. It implies that overall banks pass on 16 % impact of a change in discount rate in the first month to depositors.

The Equation 2 adds banks type wise slope dummies. The overall slope is zero but the pass through of nationalized and foreign banks is found to be 0.2 and 0.3 respectively. The parameter pertaining to privatized banks is 0.16 but is not statistically significant. Furthermore, goodness of fit measure is only 0.05.

Then equation 3 estimates the same model with AR (1) since the DW statistic is 2.3 in Eq 2. The overall parameter is not statistically significant from zero where as the slope parameters pertaining to nationalized and foreign banks are 0.2 and 0.3 respectively. The goodness of fit measure improves slightly to 0.07 and DW statistic is estimated at 1.94.

The study finds overall pass through of 0.16 in the short run between deposit and discount rate. There is found evidence of asymmetry since the pass through of various bank types is different. Overall the higher pass through of 0.3 is estimated for foreign and 0.2 for the nationalized banks. The pass through of privatized banks is estimated at 0.20 but it is not significant.

5. Conclusion

This study estimated impact of monetary policy instrument, discount rate on weighted average lending and deposit rates in Pakistan. The study has used bank type monthly data from November 2001 to March 2011. The four bank types are nationalized, privatized, foreign and specialized banks. Panel data techniques have been used for estimation of results.

The study finds that all the three variables are non stationary at levels and stationary at first difference. Pedroni Panel Cointegration technique has been applied for estimating long run relationship which reveals that lending rate is cointegrated while deposit rate is not cointegrated with the monetary policy instrument. Since lending and DR are cointegrated, PL (1991) method has been applied with bank type dummies. The results show that the overall lending rates pass through is 0.20 which is very low. However there is evidence of asymmetry among various bank types since the pass through of private, foreign and nationalized banks is estimated at 0.32, 0.25 and 0.19 respectively. The study finds evidence that lending rates pass through increased significantly during monetary policy restriction times but deposit rate remains same. The short run analysis in the case of deposit and discount rate show overall banks pass on 16 percent impact of discount rate to depositors. The pass through of Foreign and nationalized banks is 0.30 and 0.20 respectively. It further clarifies the idea that banks' profitability may be at the cost of low deposit rates and depositors are not passed on the marginal benefit of a rise in discount rate during restricted monetary policy times.

The estimates suggest that the overall effectiveness of monetary policy is limited and there is significant lag in its completeness.

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